If the earth movement took place at the Cape as an absolutely *perpendicular* vibration, would the seismograph have recorded it?

Can sudden and abnormal change in atmospheric pressure cause volcanic or other disturbance on the earth?

August 19. F. C. CONSTABLE.

IN NATURE, August 14, p. 371, it is stated that "at 7 o'clock on the morning of May 8, Mr. Ferdinand Clerc observed the needle of a large aneroid barometer pulsating violently." Above this there is, however, another note which says that "nothing unusual was observed in the barometer." But even supposing barometric perturbations to have taken place on May 8 in St. Pierre, what connection could these have had with phenomena which happened twenty days later at the Cape of Good Hope?

The Milne horizontal pendulum installed at this latter place will record disturbances originating at its antipodes, but will not respond to the rapid elastic vibrations of local shocks. You may hear seismic sounds, windows and doors may rattle, but the instrument in question will remain at rest.

The movement of an earth particle at the time of an earthquake is in all azimuths and at varying angles with the horizon. A strictly perpendicular movement seems an impossibility.

Abnormal changes in atmospheric pressure may act on a region in a state of excessive seismic or volcanic strain much in the same way as the last straw is said to act upon the camel's back; the relationship, however, is far from being pronounced. This and other questions referred to by Mr. Constable are discussed in the volumes on "Seismology" and "Earthquakes" published in the International Scientific Series. J. M.

August 26.

Larva Stage of Heliocopris Isidis.

IN the month of March last, I discovered at a depth of a few cm., among the roots of the tree *Albizzia lebbek*, several large balls of earth, varying in diameter from 5·0 to 8·5 cm. These on being broken open were found to be hollow spheres, the thickness of the wall being about 1·5 cm. This wall was composed of concentric layers of mud and bits of vegetable matter mixed, having the composition and appearance of native unburnt bricks.

Inside the sphere was a coleopterous larva about 2·0 cm. in diameter at its thickest part, about 9·0 cm. in length measured along the dorsal line, and about half that length measured along the ventral line; the larva lay on its side and assumed a curved position. A few days ago, an imago of *Heliocopris Isidis* emerged from one of the balls by boring a hole in the roof of its cell just large enough for it to pass through.

If any of these facts are new in the life-history of this beetle, they might interest your readers. FRED. FLETCHER.

School of Agriculture, Ghizeh, Egypt, August 14.

THE LAVA-LAKE OF KILAUEA.

THE recent destructive eruption in Martinique has revived interest in the question of the causes of volcanic action. Only lately have I become sensible of the peculiar value of some observations of my own as evidence of the *primary* force which impels the ascent of lava from its interior habitat, as distinguished from the explosive violence caused by steam generated by the encounter of the ascending lava with ocean and other surface waters.

I have long believed the primary force to reside in the expansion of the gases originally occluded in the magma, ever since its first condensation from the nebula. Whenever released from solidifying pressure by disturbances of the superincumbent crust, the intensely hot magma bursts into a viscid foam and pushes upwards. In a quiet volcano like our Kilauea, meeting no water to generate explosive steam, the lava wells up continuously and steadily in a comparatively gentle fountain, which displays effervescence only on the surface.

In support of this opinion I beg to offer positive evidence contained in certain facts observed by myself in Kilauea during April 8–14, 1892, and on August 28, 1894. The volcano had been in very steady and uniform action for nearly two years before the earlier date, and so continued until a short time after the latter date, or nearly five years in all of a quiet, continuous and rather copious welling up of lava, wholly unattended by any explosive action.

On the earlier date I carefully observed the then existing lava-lake during six successive days. This lake occupied the centre of the inner crater, called Hale-a-mau-mau, or Fern-hut. The main crater called Kilauea is nine miles in circumference, averaging 400 feet in depth, and rather unevenly floored with recent lava. South-west of the centre is the inner pit of Hale-a-mau-mau. This pit was at that time nearly circular

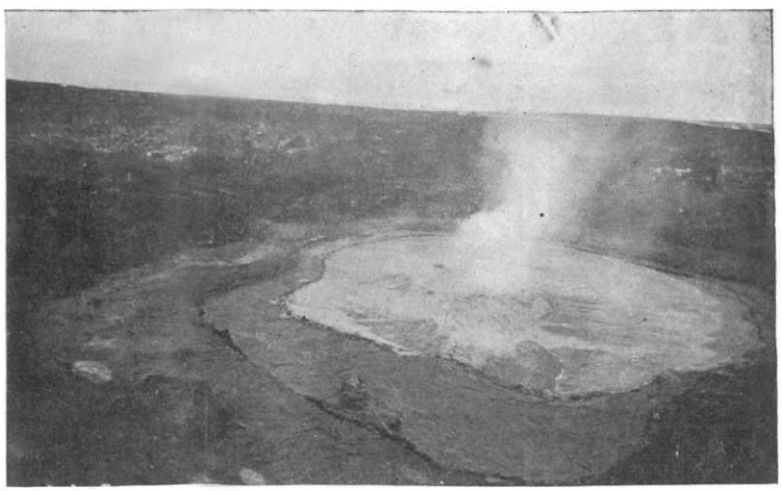

FIG. 1.—Fire-lake as seen in 1891–2.

and 2400 feet in diameter, with vertical sides averaging 150 feet down to the talus. Before the welling up of lava began in 1890, the pit had been about 700 feet deep. In two years the lava had risen 400 feet, and stood within 300 feet of the rim and main floor.

A lake of liquid lava, covered by a thin, spongy film, occupied the centre of the pit. This lake was nearly circular, averaging 850 feet in diameter. It was bordered by a low dyke, which partially restrained its frequent overflows. Outside of the dyke, freshly congealed lava sloped away to the talus. By day the crust-film was grey to the eye, but by night a deep red. It was traversed by numerous fissures of white fire. During the whole time three fountains of lava were welling up with somewhat regular intermittence, and three smaller ones at irregular intervals. There was no explosive action whatever.

The largest fountain was about 120 feet south-east of the centre of the lake. It played with great regularity about three times in a minute, rising in a round billow 25 feet high and 50 feet in diameter, bursting at the top and falling back to level, its discharge moving in a broad stream towards the centre of the lake. The fling of spray from its summit rose to 40 or 50 feet above the level.

West of this central fountain were two others of very different character, being more spasmodic in activity, but never long quiet. Occasionally they would unite their forces for half an hour at a time, forming a stationary line of 130 feet of spraying billow much like a surf-comber with flying spray. This stationary surf-wave was 15 feet high, incessantly flinging its spray 10 feet higher along its whole length. In the night, the effect of these fountains was extremely brilliant and was attended by loud metallic crashing.

The other three fountains were smaller, near the borders of the lake, and often quiet for hours together.

During the thirty months' interval between my two visits, the gradual elevation of the fire-lake continued quite uniformly, as attested by occasional photographs. By its frequent overflows it had built itself up to a height of fully 50 feet above the previous main floor of Kilauea, so that it formed an extremely low truncated cone, surmounted by the level lake, to the edge of which visitors daily approached.

About March, 1894, a recession began, which ended in a final collapse of activity. The lake soon sank some hundreds of feet, carrying with it the sides of a circular pit, about 1400 feet in diameter, and central to the original 2400-foot pit. When I saw it in the following September, the fire-lake was not less than 500 feet below the rim. During the evening, masses of rock frequently crashed in, driving heavy surges of fire far up the talus. There was a good deal of steam-cloud slowly rising, charged with sulphur. During my previous visit, all vapour had seemed to be absent, and I made the circuit of the pit without encountering sulphur. Subsequent photographs had also indicated the absence of vapour from the lake.

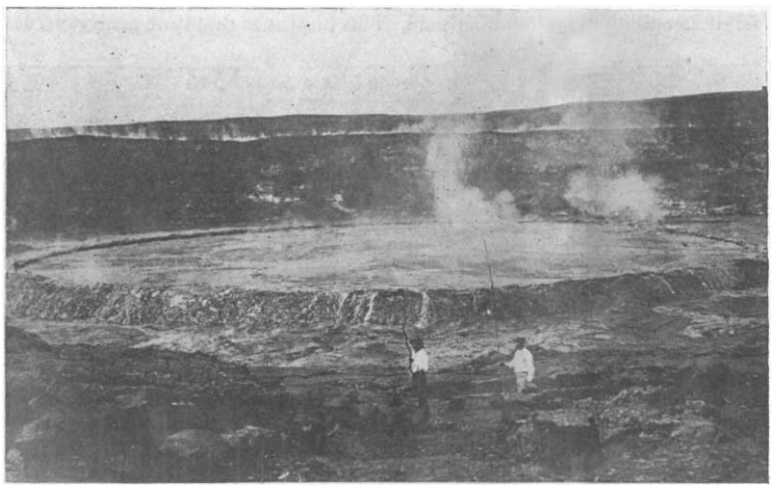

FIG. 2.—Fire-lake as seen in 1892–3. Lake gradually rose so as to overtop the rim of the pit, more than 50 feet in 1894, but all the time keeping its position and limits.

I now have to add an important observation. To my great surprise, at this last visit, I perceived that the three fountains above described were in full activity and in the same relative position as before, although during the thirty months the level of the lake had risen 350 feet and had then fallen 500 feet. By what system of supply-ducts such fountains had been so long maintained was a mystery concealed in the fire-depths. But the fact of a marvellous steadiness and uniformity of action was obvious. For a long period a uniform and gentle outpour of effervescence had been maintained. It had persisted for two years and a half, throughout all the immense changes.

I submit as the unavoidable conclusion that the source of supply for this five years' outpour of gently effervescing lava was in an interior magma which itself contained the impelling force in its own originally occluded gases. For its activity this source was wholly independent of any encounter with water to generate steam. Expanding steam evidently had no part in that steady, quiet, persistent activity in the fire-lake of Kilauea.

I would add that the exceptionally quiet and uniform activity of Kilauea seems to render it one of the most important of all volcanoes for study. I regret to say that since the collapse nearly eight years ago no lava has appeared in the crater, except a small quantity last June, which has again gone out of sight.

Having seen no European notice of the fact, I would report that twelve days after the Martinique eruption very vivid afterglows appeared here, about as bright as those seen here after the first two weeks of the Krakatoa glows in September, 1883. They have not yet wholly disappeared. The solar corona, or "Bishop's Ring," is still conspicuous. It is worth stating that the Krakatoa glows reached Honolulu in ten days, coming twice the distance of the Martinique glows in twelve days.

S. E. BISHOP.

Honolulu, July 31.

THE INFLUENCE OF EDUCATION UPON TRADE AND INDUSTRY.

A SHORT time ago the Technical Education Board of the London County Council appointed a sub-committee to report upon the "application of science to industry." The witnesses called before the committee were leaders of science and employers in various branches of industry. Dealing first with the loss of industries to the country, during the last twenty or thirty years, the committee points out that all the witnesses were practically agreed in considering the loss sustained to be due to deficiencies of our educational system. It is not so much the training of the workmen which is at fault; they even consider that the opportunities open to the London workman for obtaining technical education are superior to those enjoyed by workmen abroad. It is the want of highly trained men of science who are able to undertake research work. Prof. Dewar says he knows of no firm in England where chemists are employed in research work, while in Germany a large firm will employ a number of men for research only, who will have no connection with the business or managerial part of the works.

The causes which have operated to keep manufacturers from taking highly trained men into their works are twofold. In the first place, generally speaking, the men who have been employed as scientific experts have had a wholly inadequate training, but have often the idea, as Mr. Beilby says, that they have "nothing to learn and everything to teach." In the second place, the manufacturer is often afraid that they may learn something. He may be willing to take all they can give him, but he will not let them learn the details of the process which he desires to have improved—details which are not to be found in text-books. There is also the lack of scientific training of the manufacturers themselves, and their consequent inability to recognise the importance of scientific assistance.

With reference to our secondary education, Prof. G.